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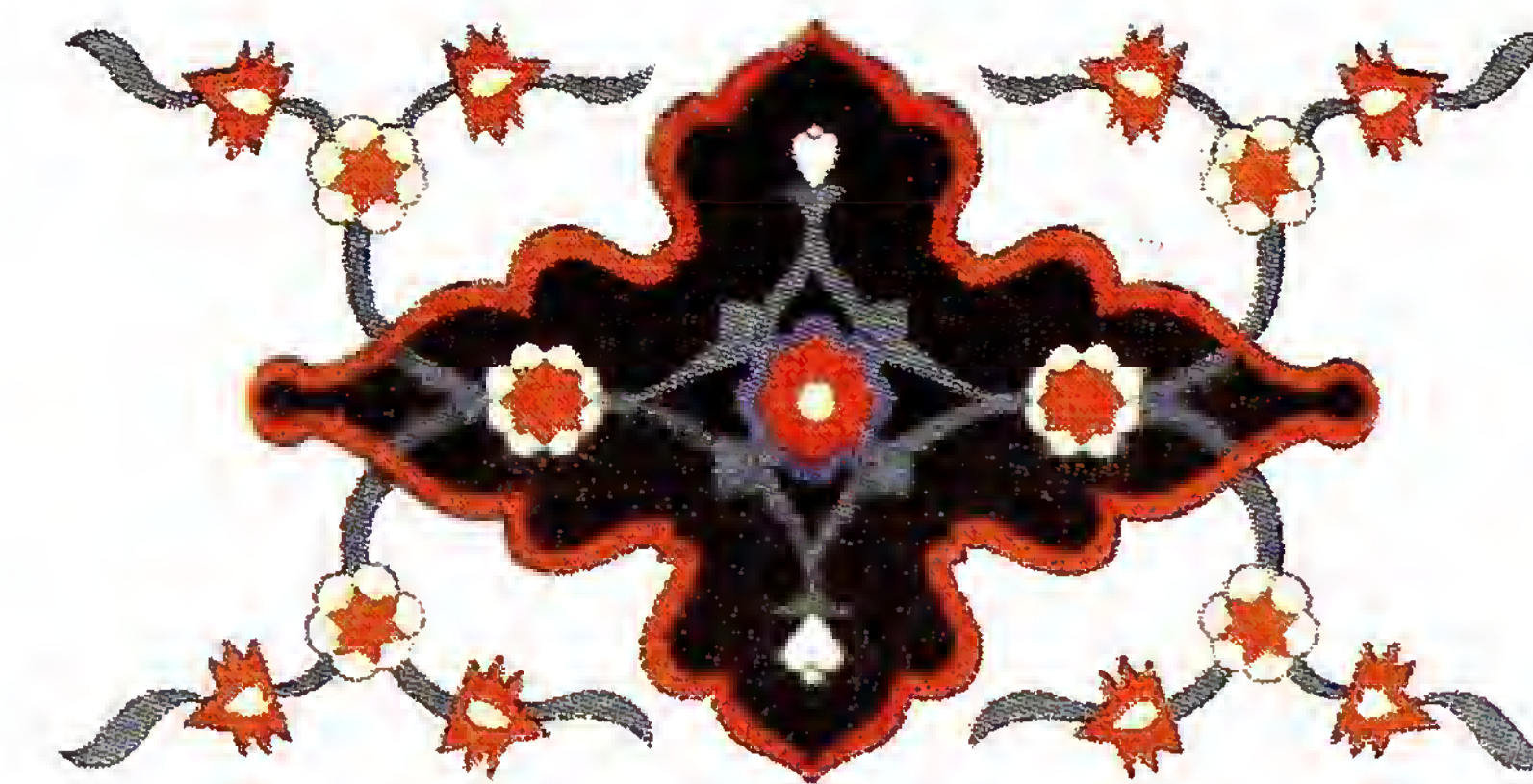
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Development of Science & Technology in Islamic History



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Publisher's Note

Science has never been separate from Islam. Objective study of this subject will reveal that Islamic texts - Qur'an and the Sunnah, provided a tremendous boost for study of the physical world and the laws that govern it. As a result, discoveries and inventions became the hallmarks of the Islamic civilization.

Recently there has been a surge in the number of publications dealing with science and its relationship with Islam. These books have focused on the various verses on the Qur'an that point to the physical world to prove that science is compatible with Islam. However, areas that are not covered enough for the English reader are the historical development of science and technology in the Muslim world, and the factors that led to its rise and decline. The decline has been so severe, that today's Muslims are not even aware that their ancestors were the founding fathers of modern sciences. Just consider the common Arabic words used in the English language today like cotton, algebra, aorta, alcohol, chemistry, earth and alkaline. They are a living testimony to the pioneering work of the Muslims.

I am proud to introduce this inspiring book to our readers. It focuses on the strides made by the Muslims in various disciplines of science and technology from the early period of the Islamic State to its last days in the 20th century CE.

The unique aspect of this book is that it sheds light on the key factors that led to the rapid advances in science and technology. Furthermore, it also analyses the reasons why Muslim World declined in this field, and last but not least, how the Muslim World can achieve the same kind of success as we already have in the past.

Abdul Malik Mujahid



"800 years of invention and prosperity"

"...I'll end by telling a story. There was once a civilization that was the greatest in the world.

It was able to create a continental super-state that stretched from ocean to ocean, and from northern climes to tropics and deserts. Within its dominion lived hundreds of millions of people, of different creeds and ethnic origins.

One of its languages became the universal language of much of the world, the bridge between the peoples of a hundred lands. Its armies were made up of people of many nationalities, and its military protection allowed a degree of peace and prosperity that had never been known. The reach of this civilization's commerce extended from Latin America to China, and everywhere in between.

And this civilization was driven more than anything, by invention. Its architects designed buildings that defied gravity. Its mathematicians created the algebra and algorithms that would enable the building of computers, and the creation of encryption. Its doctors examined the human body, and found new cures for disease. Its astronomers looked into the heavens, named the stars, and paved the way for space travel and exploration.

Its writers created thousands of stories. Stories of courage, romance and magic. Its poets wrote of love, when others before them were too steeped in fear to think of such things.

When other nations were afraid of ideas, this civilization thrived on them, and kept them alive. When censors threatened to wipe out knowledge from past civilizations, this civilization kept the knowledge alive, and passed it on to others.

While modern Western civilization shares many of these traits, the civilization I'm talking about was the Islamic world from the year 800 to 1600, which included the Ottoman Empire and the courts of Baghdad, Damascus and Cairo, and enlightened rulers like Suleiman the Magnificent.

Although we are often unaware of our indebtedness to this other civilization, its gifts are very much a part of our heritage. The technology

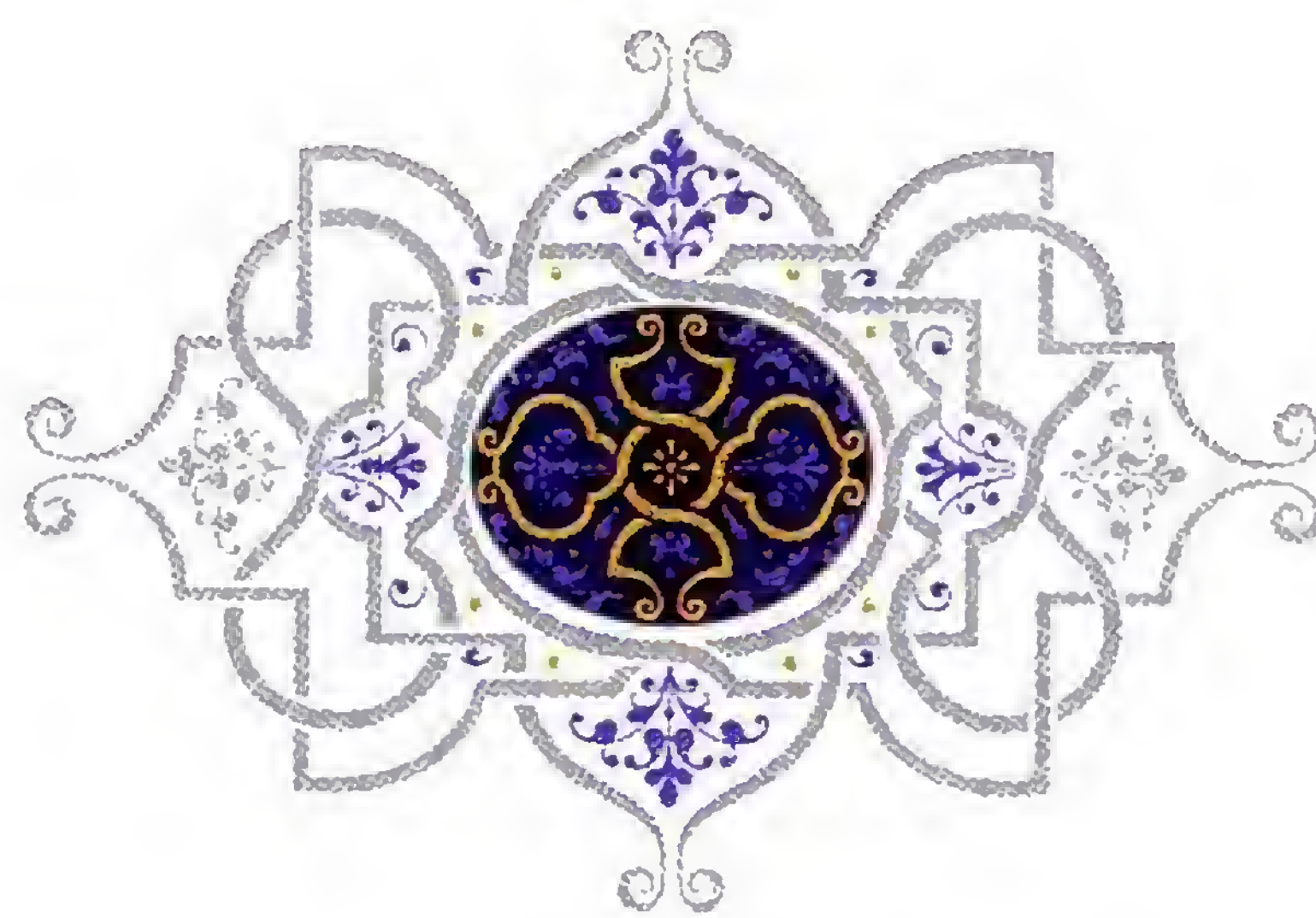


industry would not exist without the contributions of Arab mathematicians. Sufi poet-philosophers like Rumi challenged our notions of self and truth. Leaders like Suleiman contributed to our notions of tolerance and civic leadership.

And perhaps we can learn a lesson from his example: It was leadership based on meritocracy, not inheritance. It was leadership that harnessed the full capabilities of a very diverse population-that included Christianity, Islamic, and Jewish traditions.

This kind of enlightened leadership - leadership that nurtured culture, sustainability, diversity and courage - led to 800 years of invention and prosperity..."

Carly Fiorina, former CEO of Hewlett-Packard, 26 September 2001.



Introduction

In the last 300 years Europe has contributed immensely to the universal knowledge of science and technology. Tribute must be paid to the countless individuals for their outstanding work. The sheer dedication and devotion to science in Europe was second to none, and the world is in debt to this enormous contribution.

The lives and the works of many European scientist's have been scrutinized and documented in the annals of history. Their staggering contribution to science can be seen from the names of laws of sciences, inventions and recent discoveries. For example, Newton's Laws are universally known, as are the words Volts and Watts, which come from the names of the great European scientists Sir Isaaq Newton, Alessandro Volta and James Watt.

It is therefore not surprising that people often view Europe as the birthplace of science and technology. The implication of this viewpoint is that modern scientific age is exclusively the endeavor of the European nations. Many books of history point to the European scientists, like Galileo and Newton, as the fathers of modern sciences, thus reinforcing the view that Europe is the birth place of science and technology.

In the absence of any historical context, the uneducated reader can be forgiven for having a narrow view that Europe is origin of science and technology. Based on an objective study of history, it can be seen that the huge strides made in Europe in science and technology did not happen in a vacuum. Europe did not suddenly wake up one day and decided to embark on a road of scientific discoveries, as is commonly portrayed. In fact, there were two enablers that thrust Europe ahead of others in science and technology in a short period of time:

- Adoption of Capitalistic ideology
- Access to 1000 years of scientific heritage

As for adoption of an ideology, Europeans divorced Christianity from the state, and adopted Capitalism¹ as an ideology. This led to a unified

¹. Capitalism is not only a definition of an economic system based on the free market principles, but it is also used as definition of a way of life where religion is separated from the running of the state and man becomes sovereign i.e. man has the right to legislate. In this way of life, capitalistic economic system is the most prominent system in society.

vision of life, liberation in thinking, adoption of common framework for solving problems, accountability and guaranteed rights for individuals.

Furthermore, Europe had access to a millennium of rich scientific heritage. This proved invaluable for kick starting the industrial revolution, thus it became the bedrock on which Europe took the leadership in the field of science and technology.

Whose millennium of scientific heritage did Europe use? This is the fundamental question that is never answered clearly. Much is taught in Europe about the Greeks and the Romans, and then there is a leap in history to the modern times. 1000 years of history is simply lost in the middle as though this period was insignificant to mankind. This lost history is none other than the history of Islam, in which the citizens of the Islamic State led the world in many fields of human activity. The rich scientific heritage is none other than the Islamic scientific heritage that was the product of the Islamic System. In this period of 1000 years, Islam dominated and led much of the civilized world.

No mention is made of the fact that great deal of European scientific heritage actually came from the Muslims, who not only extended Greek, Persian and India works, but they were also pioneers themselves, contributing immensely to sciences. They laid foundation of various sciences though discovering laws, establishing principles and formalizing scientific thinking. It is this treasure that the West used as a springboard, yet little credit is given to Islam and the Muslims.

Furthermore, the West has always claimed that its scientific progress was a direct result of separating religion from the practical life of the people, in other words, separating the Church from the state. It is stated that religion cannot deal with the man's affairs in the ever changing modern world, and adopting it only stifles creativity and progress in many walks of life, including science and technology.

It is a fact that throughout the history of Europe, the Church was engaged in harsh treatment of the people, especially the scientists and the thinkers who opposed the views of the Church. This stagnated scientific thought and as a result, religion was perceived as impractical, inflexible, and full of contradictions. Hence, it was found to be unsuitable for the progress of humanity.

The Europeans have indeed suffered greatly under the Church. However, can generalizations be made, based on the experience of Christianity in Europe, that progress can only be made through man-made legislations and that Divine Revelation is somewhat inadequate or defective? Can this analogy also be applied to Islam? Did Islam stifle development of science and technology? Is there a contradiction between science and Islam?

This book has two main objectives:

1. To examine the argument that there is a contradiction between science and Islam. This argument originates from European experience of Christianity but it is universally applied to include all religions nowadays.
2. To highlight some of the great contributions made by Muslims to science and technology over a period of 1000 years. This scientific heritage of the Muslims formed the basis of European scientific revolution.

The book is structured in two parts:

Part 1 deals with the first objective mentioned above. It begins by tracing the historical roots of the European argument that science and religion are contradictory. It then goes to show that there is no contradiction between scientific discovery and Islam, as Islam is a way of life and not merely a set of rules related to worships devoid of reality.

Part 2 begins by showing the motivating factors that led to advances in science and technology amongst the Muslims, and then it highlights the contributions made by the scientist to various disciplines like mathematic, chemistry and so on. A list of leading scientists of the Islamic State, from the beginning of the Islamic rule in 622 CE to its end in 1924 CE, is also presented. Lastly, the factors that led to the decline of scientific thought in the Islamic State are highlighted, and Appendix provides Arabic origins of many words used today in the English language.

Part-1

The Dark Ages in Europe

The adoption of Christianity by the Roman Empire was not based on the truthfulness of Christianity or on its ability to deal with man's problems. Rather, it was adopted by Constantine in 325 CE to simply preserve the empire by building a common mentality and loyalty among the citizens. Christianity offered blind loyalty to the secular emperors, based on the understanding that the temporal authority and the spiritual authority can harmoniously co-exist.

This understanding came from the saying attributed to Jesus,

“Render unto Caesar what is Caesar's and unto God what is God's.”

Despite this, Christianity could not preserve the empire, and the demise of the Romans bequeathed many Christian states in Europe where the Church was able to dominate.

The domination of the Church meant that all affairs of life had to conform to the dogma of the Church. This caused many problems because the Bible, which the Church used as its authoritative text, dealt with only very limited matters. It gave some specific rules related to worships and foodstuffs. It gave general moral principles for Christians and set norms for their prayers and communal worship. Unlike the legislative sources of Islam, the Bible does not give detailed guidance on economy, politics, judiciary, criminal punishments, the structure and functioning of government and so on. The Qur'an informs that the Christians and Jews had changed their books so the Bible does not represent a preserved text from the Creator to man, and it leaves a huge gap when it comes to human societal affairs. This gap was an area of constant conflict of interests between kings, feudal barons and priests. During Europe's dark ages it was the priests who dominated life and when they gave judgments even kings had to submit. Yet these judgments of priests were an arbitrary and inconsistent exercise of their authority owing to the lack of a comprehensive legislative text to base their rules upon, and this laid the seeds of direct confrontation between the society and the Church.

With the passage of time, scientific discoveries were made that were at



odds with the teachings of the Church. To preserve its authority, the Church took some harsh steps against the emergence of new ideas. Many scientists were branded as heretics, infidels and satans. In 1042 AH/ 1633 CE, Galileo was forced to renounce his belief and writings that supported the Copernican theory of heliocentrism that claimed the sun was the center of the universe. The Church adamantly maintained the flawed theory of geocentrism, which stated that the earth was the center of the universe.

Also, plenty of evidence exists indicating that tens of thousands of women, who were alleged to be witches, were burnt or drowned. The response to this oppression from the people, especially the scientists, thinkers, and the philosophers such as Voltaire and Rousseau, was equally strong. They began to highlight the contradictions of the Church and called for nothing less than the separation of the Church and the state. The struggle had begun.

Desperate measures were taken by the Church to deflect the criticism, frustration and anger that were vented by the people. These measures failed to halt the flames of change that had galvanized the masses. The Church realized that it could no longer stay in charge of the state without reforming itself. Thus, the period of Reformation commenced. However, the Reformation did not guarantee any bright future for the Church as the struggle became intensified between the 16th and the 17th century CE.

The eventual outcome of the struggle for power between the Church and the thinkers and philosophers was the separation of the Church and the state. This solution was a compromise that limited the authority of the Church to preserving the morals in society and conducting rituals, and left the administration of the worldly affairs to the state. The separation between the Church and the state through the compromise solution was completed by the 18th century CE, and formed the basis of Capitalism, marking the beginning of the Enlightenment period that sparked the industrial revolution in Europe.

It is therefore clear that Europe stagnated scientifically under the arbitrary authority of the Christian Church.



Islam as an Ideology

In order to understand the relationship between science and Islam, it is necessary first to explain Islam, as it was Islam that provided the driving force of change and research in science. It is the Islamic ideology that deserves the credit and not just the individuals only.

The word 'Islam', in Arabic, linguistically means submission. As a term, 'Islam' refers to the Message that was revealed to Muhammad (ﷺ) by Allah, the One Creator, and a 'Muslim' is the one who believes in Allah, and accepts Muhammad (ﷺ) as the last and final Prophet and Messenger of Allah. Consequently, a Muslim believes in Islam in its entirety.

In sharp contrast to Christianity and Judaism, Islam is not merely a religion. Rather, Islam is a unique and comprehensive ideology that guides the life of the human being. The Islamic ideology, by the definition of an ideology, consists of both the '*Aqeedah* (creed, doctrine) and Systems, to regulate the practical life of human beings.

The Islamic '*Aqeedah* provides the correct and comprehensive answers to the fundamental questions regarding humanity's existence and that of the universe. It addresses the issue of the human being's purpose in life, and links it with what preceded life and what will come after it, thereby settling humanity's core problem and providing the basis for systems and rules to properly Organize human affairs. This '*Aqeedah* also provides the basis for a means to implement Islam in reality, thus transferring it from 'theory' to 'practice'. This means of implementing Islam is through the State. The State is an integral part of the ideology and distinguishes it from a philosophy, which provides hypothetical ideas but no means to implement them.

Islam provide a comprehensive structure to govern the affairs of human beings. It correctly establishes:

- 1) The relationship between the human being and his Creator
- 2) The personal affairs of individuals
- 3) The various relationships (social, political, economic, and international) that exist in the society

Thus, Islam constitutes a Creed and Systems. What distinguishes Islam from the ideologies of Capitalism and Communism is that Islam is built on the correct idea, whereas the others are founded on a shallow and unenlightened view of the life of the human being and the world in which he exists.

Because Islam establishes the correct understanding of life and places humanity in the correct context, the systems and culture emanating from the Islamic creed would correctly address the human nature and provide the correct solutions. In this context, Islam is compatible with the human being. Islam does not ignore a human being's instincts or desires, but organizes them in the proper context, including the survival instinct that prompts man to seek material progress through the acquisition of science and technology.

Islam is an ideology that was revealed to the world. The spread of Islam is neither confined to time or place, nor dependent upon science and technology. Although science and technology has changed the living conditions of the people around the globe, the needs and instincts of humanity have not changed. Therefore, Islam, which came to organize the needs and instincts through its implementation upon society, is applicable and valid for all time.

